

## Attachment F

### Setting a Surve Disk in Bedrock or a Structure

From NOAA Manual NOS, NGS 1, *Geodetic Bench Marks*

Sound bedrock is the most desirable setting for geodetic survey control points. Besides the ease and cost effectiveness with which a disk can be installed in bedrock, it provides the most stable setting that can be used in terms of both underground activity and disturbances inflicted by people. Always use bedrock when a suitable outcrop exists. As a rule of thumb, the bedrock is considered potentially good if the distance between joints and fissures is greater than 1 meter. The National Geodetic Survey geodetic control disks are made of brass or bronze. They are about 9 centimeters in diameter and have a spherical surface to support the foot of a leveling rod and a center point for plumbing survey equipment. Information is imprinted on this surface to identify the monument and to aid the user in obtaining data on it. This logo is recessed so that it does not interfere with the leveling rod or other survey equipment. A deformed shank, about 7.5 centimeters long, is silver-soldered or otherwise attached to the bottom surface of the disk to help prevent the disk from being dislodged.

The step-by-step procedure for setting the disk in bedrock utilizing cement is as follows:

1. Stamp the station designation and setting year on the top surface of the disk using 4.75 millimeter (3/16- inch) alpha-numeric steel dies.
2. Pick a fairly level and accessible spot on the outcrop that is intact with the bulk of the rock. A simple test can be performed to help determine the condition and integrity of the rock by placing ones hand in the area that the disk will be set, then striking the outcrop with a moderately heavy hammer and feeling for vibration. Sound outcrop will force the hammer to rebound with each impact and vibration through the rock should be minimal at best.
3. Drill a 2.5 centimeter diameter hole about 10 centimeters into the bedrock and recess the area around the top of the hole to a diameter slightly larger than that of the disk. When the installation is completed, the top of the surface of the disk should sit level and slightly below the surface of the surrounding rock. Chisel a drain channel through the low edge of the drilled recess to allow water to drain from around the finished mark. *Caution:* Safety goggles should be worn when drilling into bedrock or masonry.
4. Remove the rock powder from the hole and recessed area, flush and fill the hole with clean water, then pour cement into it. Mixing of the ingredients is done right in the hole. By adding more water and cement, make enough mortar so that an extra amount is available to place on the underside of the disk. When the mortar is completely mixed, it should be thick but still workable, like heavy mashed potatoes.
5. Clean the disk by wetting then rubbing all surfaces with cement to remove unwanted oils; rinse. Fill the depression on the underside of the disk with mortar using a trowel. Hold the disk loosely upside-down by the end of the shank then gently tap the domed surface of the disk from

below with the handle of the trowel several times to allow the mortar to settle and trapped air to escape. This is very important because it will prevent the existence of highly undesirable voids under the disk once it is in place.

6. Place the shank of the disk into the drilled hole and press the mark firmly into place. A slight rotation of the disk back-and-forth and gentle tapping with the end of the trowel handle helps settle the disk completely and evenly into the drilled recess in the bedrock. The disk is considered set when the slight back-and-forth movement stops and the disk sets firmly in place. Work excess mortar around the outer edge of the disk, making sure that it is smooth and slightly overlapping the top outside edges of the disk for security. An exposed edge of the disk would provide an area which could be used by someone or the elements to dislodge it. Fresh mortar on the upper surface of the disk can be easily cleaned off and out of any stamping.

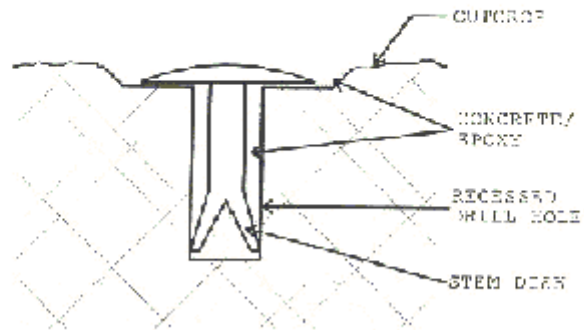
7. Sprinkle some dry cement on the exposed surface of the disk, then rub it with a clean rag or short bristled brush using circular strokes. This will clean the disk very nicely, removing all excess mortar from its surface and recessed letters. Rubbing the wet mortar around the edge of the disk in the same manner is done intentionally to finish its surface and help prevent cracking. Brush away loose cement and make sure that the finished product has a neat appearance.

8. While the mortar is still wet, it must be covered to prevent heavy rains or other foreign debris from ruining its surface and to conceal the disk from people who might tamper with it. A piece of wood, cardboard, heavy paper, or similar biodegradable item will suffice.

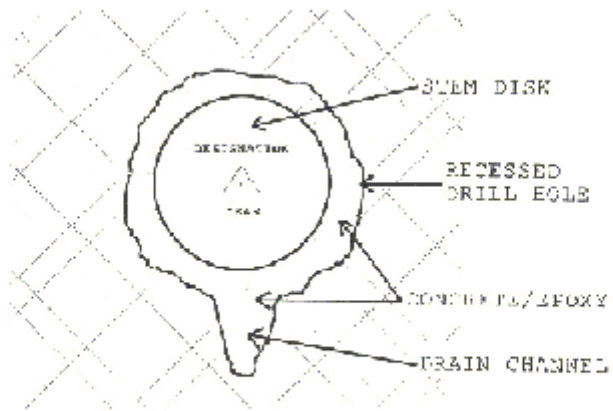
9. The installation is complete when all accumulated trash has been picked up. Leave the site clean and in good order.

Highway grade epoxy may be used in place of cement if it meets ultraviolet standards and will hold up to all weather conditions. The setting procedures are similar to those described previously except that the drilled hole, though needing to be extremely clean, cannot be wet.

## DISK IN OUTCROP



SIDE VIEW



TOP VIEW